

Ventral Hernia Repair: Outcomes Change with Long-Term Follow-Up

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ABSTRACT

Background and Objectives: Ventral hernia repairs continue to have high recurrence rates. The surgical literature is lacking data assessing the time trend to hernia recurrence after ventral hernia repairs and whether over time the recurrence rates change with laparoscopic technique compared to open repairs. Our aim was to carry out a long-term comparative analysis of ventral hernia repairs performed at our hospital over the last 10-y period to assess if outcomes change during the follow-up period.

Methods: We conducted a retrospective observational study analyzing electronic medical records of all consecutive patients who had a ventral hernia repair from January 2001 to February 2010 at our hospital.

Results: During the study period, 436 ventral hernia repairs were performed: laparoscopic repairs (n=156; 36%), laparoscopic converted to open (n=8; 2%), and open repairs (n=272; 62%). We analyzed the time distribution to hernia recurrence after surgery and found that 85% of recurrences after laparoscopic repairs and 77% of recurrences after open repairs occurred within 2 y of surgery. We did a Kaplan-Meier analysis for the subgroup of patients for whom we had a minimum 4-y follow-up and found that there continued to be a low subsequent yearly recurrence rate for open repairs after the initial 2-y follow-up.

Conclusion: Most hernia recurrences occur within 2 y after surgery for ventral hernias. There appears to be a continued although low subsequent yearly rate of recurrence for open repairs.

Key Words: Ventral Hernia, Laparoscopic, Open, Surgery, Recurrence.

INTRODUCTION

Ventral hernias are one of the most common problems confronting general surgeons. The rate of ventral incisional hernia in the long term after laparotomy has been reported to be as high as 20% to 25%. Multiple studies have suggested that laparoscopic repair of ventral hernias carries a lower recurrence rate and shorter hospital stay with quicker recovery.¹⁻⁵ Heniford et al.⁵ in their study of 100 consecutive laparoscopic repairs had a recurrence rate of 3% at 23-mo follow-up. Isolated studies however have argued that the recurrence rate with laparoscopic repair may not be that low over a long-term follow-up, and argued that over a longer term, the recurrence rate with laparoscopic repairs is the same as with open repairs⁶ and may actually even be worse.⁷ The surgical literature is however lacking data that compare the recurrence rates with the open and laparoscopic techniques over a long-term follow-up. The primary objective of our study was to carry out a large comparative analysis of both techniques with cases performed at our hospital over almost the last 10 y to assess changes in recurrence rates with period of follow-up obtained.

Multiple associated conditions, such as obesity, smoking, and others, have been reported in various studies to contribute to higher recurrence rates.² Using our long-term follow-up data, we also analyzed multiple comorbid conditions to see if there was an association with a higher recurrence rate in our patients.

METHODS

Electronic medical records of all consecutive patients who had a ventral hernia repair from January 2001 to February 2010 at our hospital were retrospectively reviewed. Although this was a retrospective chart review and patients were not contacted by telephone, long-term follow-up of patients in our integrated healthcare delivery system is facilitated by our large primary care network, established electronic medical records, and rural location. We believe the strengths of our study that enable us to obtain excellent patient follow-up are that we are the only tertiary care hospital serving a rural population for a considerable distance, we have a large

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primary care network, and all facilities are connected with an electronic medical database. We do recognize that a few patients may have still been lost to follow-up and a few recurrences could have been missed for reasons such as relocation. All operative reports, clinic notes including visits with the surgical providers and primary care providers, and imaging reports were reviewed. Data were collected using a standard Microsoft excel worksheet. We included all ventral hernia repairs including primary and recurrent hernia repairs. Every recurrent hernia repair during the time period of the study was counted as a separate patient episode. We excluded ventral hernia repairs that were carried out as a part of other procedures from our study. We collected data on multiple parameters, including type of repair, size of hernia, number of hernia defects (Swiss cheese type defects), type of mesh used, size of mesh, estimated blood loss (EBL), patient comorbidities, patient BMI, number of prior surgeries, recurrence and complications.

Data Analysis

We analyzed our data with the help of SPSS version 16 statistical software. Our primary outcome measure was the recurrence rate. We analyzed the progression of overall recurrence rates with the follow-up duration. We then compared the laparoscopic and open techniques for changing recurrence rates as the follow-up duration increased. We then did a subgroup analysis of patients for whom we had a minimum of 4 y follow-up (operated on before February 2006), enabling us to plot a Kaplan-Meier survival (no recurrence) curve comparing the laparoscopic and open techniques up to 4 y from surgery. Because data recorded about hernia size and mesh size were inconsistent, that being a limitation of a retrospective study, we excluded them from our analysis. For the purpose of analyzing recurrence rates and complications, the 8 patients who had a laparoscopic procedure converted to open were treated as open procedures. The χ^2 test was used as a test of significance. All of the tests were 2-tailed. $P < .05$ was considered significant.

RESULTS

During the study period, 436 ventral hernia repairs were performed. The distribution of surgical repair was laparoscopic repairs (n=156; 36%), laparoscopic converted to open (n=8; 2%), and open repairs (n=272; 62%). The sex distribution was male (n=213; 49%) and female (n=223;

51%). The mean age of patients was 56.5 y, and median age was 58 y. Most patients had undergone previous abdominal surgery (n=374; 86%). A previous ventral hernia repair had been performed in n=131 (30% of patients). Of the patients undergoing a recurrent hernia repair (n=94), 22% had undergone one previous repair while (n=37) 9% had undergone more than one previous repair.

A hernia recurrence occurred in 14.0% of patients. Overall, significantly lower recurrence rates were observed in our patients with laparoscopic ventral hernia repairs compared to open hernia repairs ($P = .032$) (**Table 1**). The recurrence rates were higher in patients with previous ventral hernia repair (n=20; 16%) compared to patients without any previous repairs (n=41; 13%) ($P = .55$). Patients with more than one previous hernia repair had yet higher overall recurrence rates (n=7; 19%) compared to patients with just one previous repair (n=13; 14%) although this too was not statistically significant ($P = .49$).

Time to Recurrence for Ventral Hernias

We looked at the time to hernia recurrence for all patients who had a recurrence. This was taken as time when they first noticed a recurrent bulge after surgery rather than the time they presented to the surgical clinic or their primary care provider with it. We found that 54% of the recurrences after laparoscopic repair and 67% of the recurrences after open repair occurred within the first year after surgery. However by the end of the second year after surgery, 85% of the recurrences after laparoscopic surgery had occurred while 77% of the recurrences after open surgery had occurred (**Table 2**). When we plotted the trend in recurrence rates for laparoscopic compared to open procedures, we found a narrow distribution for the laparoscopic repairs with most recurrences occurring within 16 mo of surgery,

Table 1.
Comparison of Recurrence Rates in Laparoscopic Versus Open Procedures

	Number	Recurrence (%)	No Recurrence (%)
Laparoscopic	156	13 (8.3)	143 (91.7)
Open	272	46 (16.9)	226 (83.1)
Lap converted to open	8	2 (25.0)	6 (75.0)
Total	436	61 (14.0)	375 (86.0)

Table 2.

Year of Hernia Recurrence for Laparoscopic Compared to Open Procedures

	Total	1 st year	2 nd year	3 rd year	4 th year	5 th year	6 th year	7 th year
Laparoscopic	13	7 (53.8%)	4 (30.8%)	0 (0.0%)	0 (0.0%)	1 (7.7%)	1 (7.7%)	0 (0.0%)
Open	48	32 (66.7%)	5 (10.4%)	5 (10.4%)	2 (4.2%)	1 (2.1%)	2 (4.2%)	1 (2.1%)

although few recurrences continued to occur after open repairs (**Figure 1**).

Subgroup Analysis of Patients with Minimum 4 Years of Follow-Up

To enable us to plot a Kaplan-Meier curve up to 4 y from surgery, we did a subgroup analysis of patients for whom we had a minimum 4-y follow-up. A total of 191 patients who were operated on before February 2006 were included in the subgroup analysis (**Table 3**). We then plotted a Kaplan-Meier survival (no recurrence) curve comparing the laparoscopic and open techniques with time from surgery (**Table 4**) (**Figure 2**).

Table 3.

Subgroup Analysis with Comparison of Recurrence Rates in Laparoscopic Versus Open Procedures

	Number	Recurrence (%)	No Recurrence (%)
Laparoscopic	64	9 (14.1)	55 (85.9)
Open	127	35 (27.6)	92 (72.4)
Total	191	44 (23.0)	147 (77.0)

Occult Hernia Defects

In our study, occult hernias (Swiss cheese defects) were observed significantly more frequently in patients under-

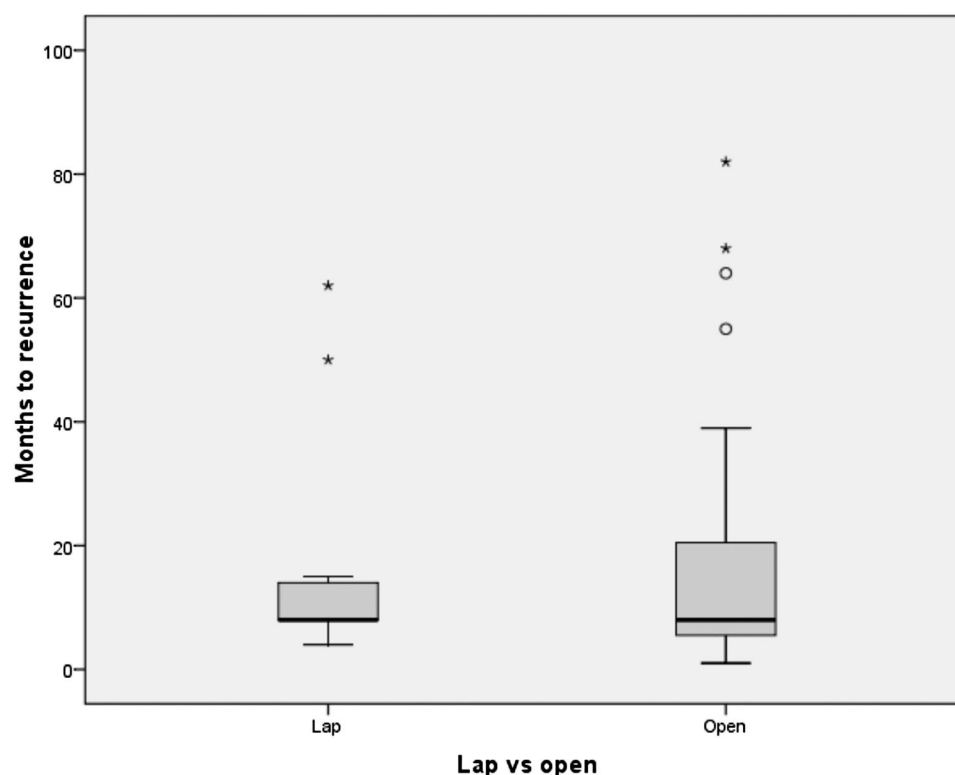
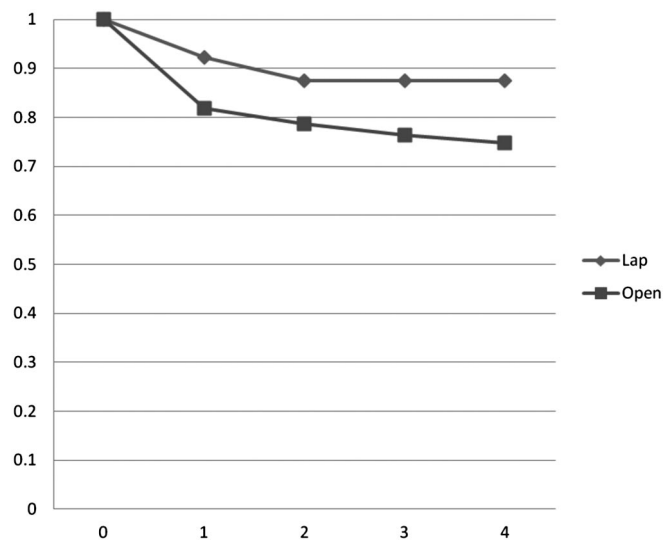


Figure 1. Distribution of time to hernia recurrence for laparoscopic versus open procedures.

Table 4.

Number of Yearly Recurrences for Patients with Minimum 4-Year Follow-up

	1 st year	2 nd year	3 rd year	4 th year
Laparoscopic	5	3	0	0
Open	23	4	3	2

**Figure 2.** Kaplan-Meier comparison curves up to 4 y from surgery.

going laparoscopic repair (32%) compared to patients undergoing open repair (23%) ($P = .036$) (**Table 5**).

Comparison of Comorbid Conditions

We compared the recurrence rates in patients based on absence or presence of various comorbid conditions. The only comorbid conditions that were found to be associated with a significantly higher recurrence rate in our study were asthma ($P = .049$) and immune-suppression ($P = .001$) (**Tables 6 and 7**). We further analyzed the distribution of recurrence rates in asthmatic and immune-

Table 5.

Comparison of Swiss Cheese Defects Noted in Laparoscopic Versus Open Procedures

	Total	Absent (%)	Present (%)
Laparoscopic Repairs	156	106 (67.9)	50 (32.1)
Open Repairs	280	216 (77.1)	64 (22.9)
Total	436	322 (73.9)	114 (26.1)

Table 6.

Comparison of Recurrence Rates in Asthmatic Versus Nonasthmatic Patients

	Total	No recurrence (%)	Recurrence (%)
Asthmatic	31	23 (74.2)	8 (25.8)
Not asthmatic	405	352 (86.9)	53 (13.1)
Total	436	375 (86.0)	61 (14.0)

Table 7.

Comparison of Recurrence Rates in Immune-suppressed Versus not Immune-suppressed Patients

	Total	No recurrence (%)	Recurrence (%)
Immune-suppressed	29	19 (65.5)	10 (34.5)
Not Immune-suppressed	407	356 (87.5)	51 (12.5)
Total	436	375 (86.0)	61 (14.0)

suppressed patients by laparoscopic versus open technique and found no significant difference (**Table 8**). There was no significant difference in recurrence rates for multiple other conditions including age, diabetes, hypertension, BMI, smoking, CHF, chronic kidney disease, peripheral vascular disease, intraoperative blood loss, and type of mesh used (**Figure 3**). The mean BMI of patients who did not have a recurrence of the hernia was 32.6, and the mean BMI of patients who did have a recurrent hernia was 33.2.

Mesh Type and Recurrence Rates

We analyzed the various types of mesh used and compared the overall recurrence rates with the different types of mesh (**Table 9**). Recurrence rates were slightly lower in the patients with primary repair without mesh; however, these were usually small <2cm in diameter hernia defects. Although we collected data on the size of hernia defects, the size was not clearly documented in over half the patients and often graded as a small or large defect so we could not study that. A biological mesh was chosen in the setting of a contaminated field. The choice for other types of mesh seemed to be surgeon preference and likely changed as some mesh types fell out of favor with time; however, it is difficult to comment on it in the setting of a retrospective study. The noncomposite non-PTFE meshes used included polypropylene, Bard (monofilament Prolene), C-QUR, and Marlex. We did not perform statis-

Table 8.

Recurrence Rates in Asthmatic and Immune-suppressed Patients Compared by Laparoscopic Versus Open

Co-morbidities	Frequency (%)	Recurrence rate (%)	Lap (%)	Open (%)	P-Value
Immune-suppression	29 (6.6)	10 of 29 (34.4)	1 of 6 (16.7)	9 of 23 (39.1)	.3
Asthma	31 (7.1)	8 of 31 (25.8)	3 of 14 (21.4)	5 of 17 (29.4)	.6

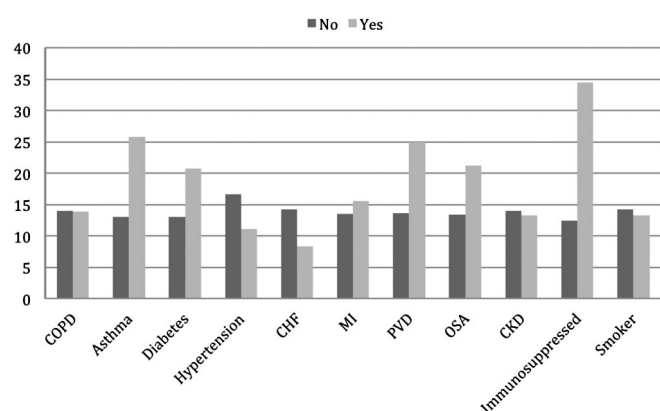


Figure 3. Comparative percentages of recurrence rates in patients based on absence or presence of various comorbid conditions.

Table 9.

Mesh Type Versus Recurrence Rates

Mesh Type	Number	No recurrence (%)	Recurrence (%)
None	127	114 (89.8)	13 (10.2)
Composite	164	136 (82.9)	28 (17.1)
Noncomposite (Non PTFE)	27	24 (88.9)	3 (11.1)
PTFE	97	83 (85.6)	14 (14.4)
Biological	21	18 (85.7)	3 (14.3)
Total	436	375 (86.0)	61 (14.0)

tical analyses, because the numbers in some groups were very low.

Complications of Surgery

Complications occurred in 12.4% of patients overall, with a slightly different distribution in the laparoscopic and open surgery groups (**Table 10**). A persistent seroma was the most common complication in the laparoscopic surgery group, while wound infection was the most common complication in the open surgery group. Postoperative

Table 10.

Complications of Surgery and Distribution in the Laparoscopic and Open Groups

Complication	Lap (%)	Open (%)	Comparative P Value
Seroma	10 (6.4)	7 (2.5)	.04
Wound infection	2 (1.3)	11 (3.9)	.12
Mesh infection/ Abscess	2 (1.3)	4 (1.4)	.90
Hematoma	0 (0.0)	2 (0.7)	.29
Bowel obstruction	4 (2.6)	2 (0.7)	.11
Bowel perforation	1 (0.6)	0 (0.0)	.18
Severe pain	1(0.6)	2 (0.7)	.93
Death	1 (0.6)	0 (0.0)	.18
Urine retention	2 (1.3)	1 (0.4)	.26
Respiratory insufficiency	1 (0.6)	2 (0.7)	.93
Total	56	280	436

bowel obstruction occurred more frequently in the laparoscopic group. There was one death in the immediate postoperative period in the laparoscopic surgery group in a patient who suffered from respiratory failure, sepsis, and pseudomembranous colitis.

DISCUSSION

The primary objective of our study was to assess the change in recurrence rates as the time after surgery elapses and for that we wanted to obtain a large database with patients spread out over a large operative time range. This was enabled by carrying out a retrospective study of all consecutive patients who underwent ventral hernia repairs over a 9-y period. Our findings indicate that most recurrences after both laparoscopic and open repairs occur within 2 y of surgery. By doing a Kaplan-Meier analysis, we found that for open repair recurrences continued in the subsequent years with a low frequency, but fairly even distribution. Multiple studies have compared recurrence rates in laparoscopic and open ventral hernia repairs; however, generally the follow-up period has been small except

for a few studies that too have not trended the recurrence rates with time and duration of follow-up.

It can be hypothesized that better outcomes with laparoscopy may be related in part to better identification and repair of multiple occult defects (Swiss cheese type defects) with laparoscopy. Saber et al.⁸ reported a 48% incidence of occult hernia defects in their series of 146 laparoscopic repairs. In our study, occult defects were noted significantly more with laparoscopic surgery (32%) compared to open surgery (23%) ($P = .036$), which supports the theory that identification of occult defects is improved with laparoscopy.

Studies have shown that generally the size of hernia defects and size of mesh used were bigger with laparoscopy, and just wider coverage of the anterior abdominal wall with mesh can hence also be hypothesized to result in reduced recurrence rates with laparoscopy.^{9,10}

We studied various comorbid conditions for their association with higher recurrence rates. In our study, the only conditions that seemed to be associated with higher recurrence rates were asthma and immune-suppression, so we performed a literature search to look for recurrence rates in patients with these conditions. A few other studies have found recurrence rates to be higher in patients with asthma.^{11,12} Most of the data in immune-suppressed patients come from studies of ventral hernia repairs in transplant patients. Kennealey et al.¹³ quoted a recurrence rate of 23% in their series of laparoscopic ventral hernia repairs in solid organ transplant patients, although their median follow-up period was relatively short at 589 d. We did not observe any significant difference when we compared the laparoscopic and open repairs in patients with asthma and immune-suppression, although the numbers in those groups were low.

Our complication rates were similar in the open and laparoscopic surgery groups. Wound infection and mesh infection were less frequent in the laparoscopic surgery group; however, more serious complications such as bowel perforation and bowel obstruction were higher in the laparoscopic surgery patients. Heniford et al.¹⁴ found a complication rate of 13.2% in their large series of 850 laparoscopic ventral hernia repairs. Our complication rates and types of complications were similar to those quoted in the literature, and other studies have found lower overall complication rates however more serious complications with laparoscopic repairs.^{15–18} Due to the retrospective nature of our

study, we do recognize that all complications may not be picked up from a chart review.

CONCLUSION

A limitation of our study is that it is retrospective; however, this enabled us to obtain a long duration of follow-up, so we were able to assess the change in hernia recurrence rate with time from surgery comparing laparoscopic and open techniques, which has not been done in previous studies. Our study shows that close to 80% of recurrences after ventral hernia repairs occur within the first 2 y of surgery (within 16 mo for laparoscopic repairs). For open repairs, there appears to be a subsequent low but continued yearly rate of recurrence. Prospective longitudinal studies will help to further confirm our findings although they will require a long-term follow-up analysis.

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